DEVELOPMENT OF REMOTE REAL TIME TEMPERATURE MONITORING SYSTEM BY USING WIRELESS SENSOR NETWORK

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ABSTRACT

Monitoring system has employed in various applications, including temperature, pressure, flow rate, capacity, acceleration, and so on. This monitoring is commonly use in all area of the world n traditional method of farming, human labors were required to visit the greenhouse at specific time and need to check the temperature level manually. This conventional method is considered time consuming and needs a lot of work and effort. Therefore this research focuses on developing a system that can remotely monitor and predict changes of temperature level in agricultural greenhouse. The objective of the research is to develop the remote real time temperature monitoring system by using Zigbee network. The proposed system has measurement which capable of detecting the level of temperature. This system also has a mechanism to alert farmers regarding the temperature changes in the greenhouse so that early precaution steps can be taken. In this research, several tests had been conducted in order to prove the viability of the system. Test results indicated that the reliability of the system in propagating information directly to the farmers could be gained excellently in various conditions.

ABSTRAK

Sistem pemantauan bekerja dalam pelbagai aplikasi, termasuk suhu, tekanan, kadar aliran, kapasiti, pecutan, dan sebagainya. Pemantauan ini biasanya digunakan di semua kawasan dunia ini dalam kaedah tradisional perladangan dimana tenaga kerja manusia yang diperlukan untuk melawat rumah hijau pada masa tertentu dan diperlukan untuk memeriksa tahap suhu secara manual. Ini kaedah konvensional dianggap memakan masa dan memerlukan banyak kerja dan usaha. Oleh itu, kajian ini memberi tumpuan kepada pembangunan sistem yang jauh dimana boleh memantau dan meramal perubahan tahap suhu dalam rumah hijau pertanian. Objektif kajian untuk membangunkan sistem pemantauan suhu masa dengan menggunakan rangkaian ZigBee. Sistem yang dicadangkan mempunyai ukuran yang mampu mengesan tahap suhu. Sistem ini juga mempunyai mekanisme untuk memberi amaran kepada petani mengenai perubahan suhu dalam rumah kaca supaya langkah-langkah berjaga-jaga awal dapat diambil. Dalam kajian ini, beberapa ujian telah dijalankan untuk membuktikan daya maju system ini. Keputusan ujian menunjukan bahawa sistem ini dalam menyebarkan maklumat secara langsung kepada petani adalah berkesan.

TABLE OF CONTENTS

LIST OF FIGURE

LIST OF TABLES

LIST OF ABBREVIATIONS

GUI	Graphical User Interface
PC	Personal Computer
V	Volt
DC	Direct Current
MHz	Mega Hertz
EIA	Electronics Industries Association
ADC	Analog to Digital Converter
USB	Universal Serial Bus
cc	Clock Cycle
°C	Degree Celsius
GND	Ground
Vcc	5V DC
LED	Light Emitting Diode
GSM	Global System for Mobile communication

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Overview

Long time ago, traditional monitoring system mostly introduced wired connections mode, and very relevant alarm needs wiring. This kind of design needs a large amount of investment and complex of work .It can never meet the practical requirements of intelligent agricultural monitoring system. So distributed intelligent monitoring system will have more market possibility, which is safer, easier to install and lower in cost. In recent years, wireless communication technology has been widely used in the applications of remote data communication. Besides that, the improvement in technology growth larger, advance and more sophisticated.

This project used the application of by Zigbee network using transmitter terminal and receiver terminal to monitor the temperature in the greenhouse. The whole process that was described here is focus only on hardware part. It was known that when the farmer not at the greenhouse, the temperature maybe increase. So, in order to ensure that the temperature in that area do not rise so

high that will make farmer feel not comfortable, sensor will detect the temperature. Thus, the system that can fulfill the requirement of this project is the circuit installed in the greenhouse must consist of four main components which is temperature sensor to detect heat, PIC microcontroller that can use to analyze the data and of course Zigbee module which is the function is to transmit the data to the receiver.

1.2 Problem statement

The concern about a lot of customer needs and demand for agricultural product has make farmer was awareness to increase their product by implementing new technology in this industry. The most important thing that may come to farmer's interest is how to control the use of natural environment and natural sources such as soil and water. However, this research focuses more in monitoring levels of temperature in greenhouse.

Previously, human labors were required to visit the green house at the specific time and need to check temperature level manually. This type manual practice is apparently time consuming and needs a lot of works and efforts. The critical plants such as vegetables and flowers need 24 hours attention from human so that the quantities and qualities of the plants can be controlled. With the improvement of management in agriculture techniques and modern telecommunication technology can be implemented.

1.3 Project Objectives

Each project must have the objective to state the purpose of the project or what you are trying to achieve through the investigation. So, for this project, there are two (2) main objectives which are;

i. To develop the remote real time temperature monitoring system by using Zigbee technologies

ii. To construct and develop the model of the circuit design (hardware part)

1.4 Project Scopes

i. To develop a temperature monitoring and alert system using PIC microcontroller that is connected to the Zigbee module.

ii. To write a program that can send signal using assembly language in PIC C Compiler

iii. To combine the system to be one complete system that can be user friendly

1.5 Thesis Outline

Temperature Monitoring System final thesis consist of 5 chapters that explain different part of the project. Each chapter elaborates all part of hardware and software about this chapter. The content also consist of information about the project and the component used as illustrate in literature review

Chapter 1: Introduction of the project. The introduction about this research is the objectives and problems that lead to the implementation of this research are stated. The chapter starts with general information of Zigbee communication and the project background.

Chapter 2: Literature reviews for development this project. Let explains the literature study regarding temperature monitoring system project based on recent journals and papers. The information also comes from few resources in internet that can be trusted. Generally, most of the literature discuss about project module from the basic concept to its application to this project and engineering fields.

Chapter 3: Methodology of this project. It will be more focus methodology of the project. This chapter discusses the full methodology of the overall project. Hardware architecture and software implementation of the project is shown in this chapter. This chapter discusses about the architecture of the project that consists the hardware design and the software implementation

Chapter 4: Result and Analysis. It provides an outline of the results obtained from the transmitter board and receiver board Detail explanation of the result starting from the input until the output will be further discussed in this chapter.

Chapter 5: Conclusion. Conclusion is the last chapter and it contains the brief summary for the whole research from the beginning until it is completed. Conclusion is included as well as some recommendations for future research on temperature monitoring system.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Inside this chapter, brief description on each project module that was used in this project will be stated. Besides that, some elaboration on fundamental of data transmission and can be fined in this chapter.

2.2 Remote Monitoring in Agricultural Greenhouse

In this paper, the objective of the research is to develop a remote temperature monitoring system using wireless sensor and Short Message Service (SMS) technology. The proposed system has a measurement which capable of detecting the level of temperature. This system also has a mechanism to alert farmers regarding the temperature changes in the greenhouse so that early precaution steps can be taken. In this research, several tests had been conducted in order to prove the viability of the system. Test results indicated that the reliability of the system in propagating information directly to the farmers could be gained excellently in various conditions. [1]

In this paper, they also made a prediction on the price reduction for remote monitoring sensor products as shown in the graph in Figure 2.1. Based on this work, we may conclude that the price of the products will continue to reduce though it may not follow the same pattern. [1]

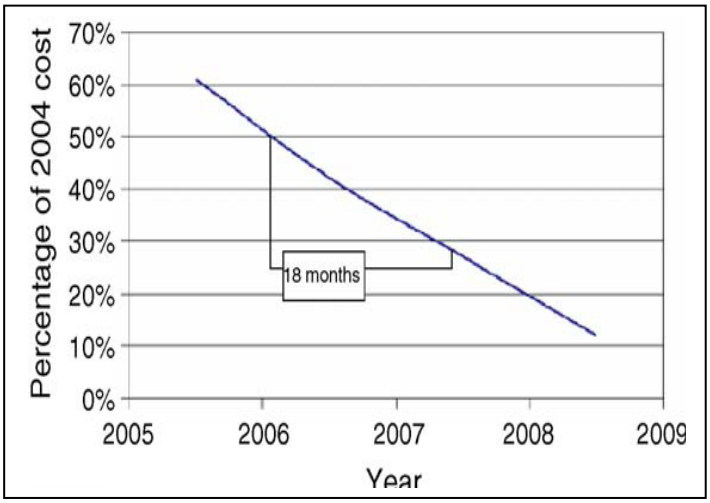

Figure 2.1: Projected price reduction for remote monitoring products

The paper does study on effect of temperature changing in greenhouses. Based on their case study of strawberry farm, MARDI had provided the information which is summarized in the Table 2.1. [1]

Table 2.1: The humidity and temperature affect significantly to the quality of strawberry.

Effect	Example
Developed disease	White rash
Lost of nutritional value	Vitamins
	Minerals
Over-ripen	Texture damage easily
	Rotten quickly
Texture	Toughness
	Firmness / softness
	Juiciness
Appearance	Size
	Color
	Shape / form
Flavor	Sweetness
	Acidity
	Bitterness

2.3 A Zigbee Based Wireless Sensor Network

This project proposed about Blockages in sewers is major causes of both sewer flooding and pollution. Water companies which fail to tackle this problem face hefty fines and high operational costs if they unsuccessful to provide a practical solution to prevent flooding. As a result, the detection of sewer condition is routinely required to inform on the best course of action to eliminate

this critical problem. This paper presents a novel low cost wireless sensor technology to detect blockages proactively, and feed these event data back to a central control room. The practical deployment of the proposed WSN in an urban area will be demonstrated. In addition, the challenges of this technology in a field trial and the recorded data in terms of the sensor and communication reliability will be addressed. [2]

2.4 Greenhouse

Article analysis the commercial greenhouse vegetable production is an exacting and costly enterprise. Only expert management can prevent large-scale financial losses. Publications providing general information are available from libraries. Although several companies offer package investment opportunities, supplying equipment, materials and advice, none of these can guarantee success. In greenhouse production there is no substitute for experience. Temperature requirements for major greenhouse vegetables differ between vegetables and stages of growth. For cucumbers, temperatures should be kept between 75 and 77 F during the day and 70 F at night until the first picking. When picking started, we must, reduce temperatures 2 degrees. After picking is started, night temperatures may be reduced 2 degrees per night gradually to 63 F temporarily (for 2-3 days) to stimulate growth. Exceeding maximum temperatures temporarily can be used to cause some flower abortion and maintain the fruit-vine balance. In general, cooler temperatures are used when light intensities are low. [3]

2.5 Greenhouse Activity

The investigate in greenhouse is done with found the article that related in greenhouse activity. The objective if this article is to maintain the temperature inside the structure during cold or hot season and produce any selected crops. The structure also provided by heat control equipment to ensure the suitable temperature for the crops. The tropical greenhouse mainly built for protection of crops inside the structure from heavy rain and direct sunlight effect. The heavy rain especially monsoon season able to damage leafy vegetables and certain food crops. The structure mostly covered with 32 meshes netting to inhibit any pests to enter inside structure. The trend of greenhouse technology is more accepted my many farmers in Malaysia. [4]

Second article said that the vegetable crops research program covers a wide range of commodities which include chilli, tomato, long bean, cucumber, okra, brinjal, French bean, kalian, and a number of temperate vegetable types such as cabbage, cauliflower, broccoli, chinese cabbage, lettuce and bell pepper. The present hectarage of vegetables in Malaysia is around 44,000 hectares and it is mostly under small holdings. Research & Development (R&D) is vital to sustain these crops and to develop efficient and cost-effective large scale production systems. R&D activities are focused on the following thrust areas. The thrust areas is Technologies developed will be disseminated to the local industry through advisory services, consultancy, exhibitions, seminars, training & extension services, contract research, networking and collaboration with agricultural agencies, which are expected to support the needs and accelerate the growth of the vegetable industry.[5]

CHAPTER 3

METHODOLOGY

3.1 Introduction

The methodology consists of overall of systems, hardware development and software development. The overall of the systems divides into three important parts that gives function to the board.

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3.2 Overall System

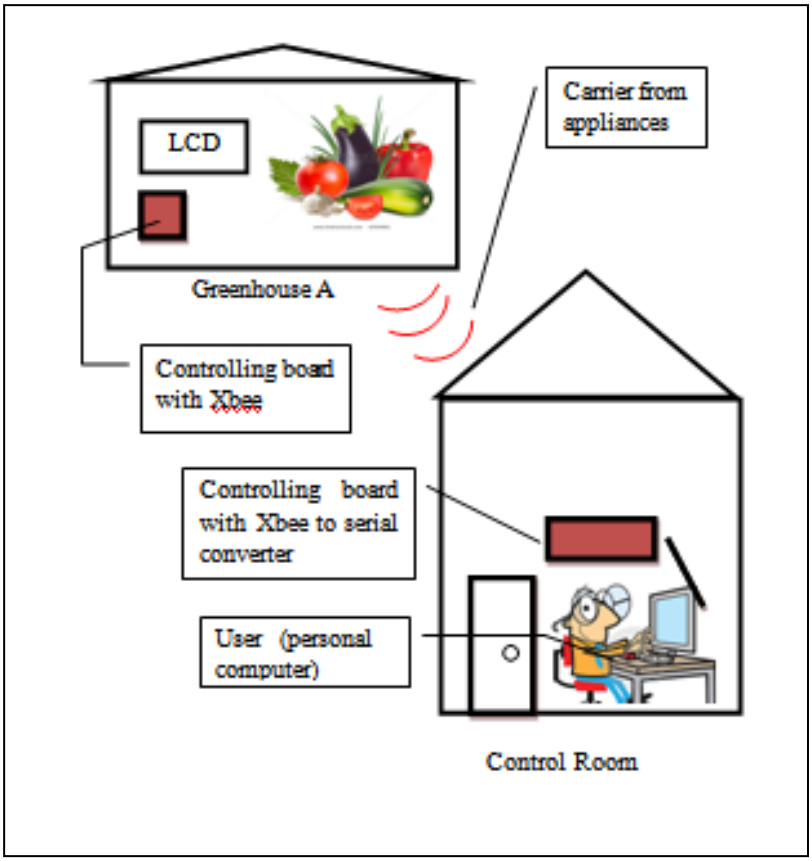

Figure 3.1: Methodology of overall system (block diagram)

After create a proper GUI by using Labview in personal computer (PC), the user now is able to identify the status of greenhouse. Firstly, the sensor was detected the temperature in the greenhouse. Then, the controlling board will send the value to control room in binary value by using Zigbee module also knows as transmitter. Secondly, Zigbee module will detect the value that function as receiver. The coding in microcontroller was develop to receive data and sent it to the PC through the serial converter. The methodology of overall system was shown in Figure 3.1.